

WHAT IS CLAIMED IS:

1. A method for detecting a malaria parasite comprising:

releasing the malaria parasite by allowing an erythrocyte in a specimen to undergo hemolysis;

staining the released malaria parasite with a fluorescent dye to prepare a measurement sample;

detecting optical information from the measurement sample; and

distinguishing the malaria parasite based on the optical information obtained;

wherein the specimen is treated with a first hemolytic agent comprising a first surfactant to form a treated specimen; and

wherein the treated specimen is further treated with a second hemolytic agent comprising a second surfactant having a hemolytic activity higher than that of the first surfactant.

2. The method of claim 1, wherein the hemolytic activity of the second hemolytic agent enables sufficient hemolysis of reticulocyte remaining in the treated specimen but does not damage the malaria parasite.

3. The method of claim 1, wherein the first surfactant comprises a nonionic surfactant.

4. The method of claim 1, wherein the second surfactant comprises an anionic surfactant.

5. A method for detecting a malaria parasite in a sample comprising:

treating the sample with a first hemolytic agent comprising a first surfactant to form a first treated sample;

treating the first treated sample with a second hemolytic agent comprising a second surfactant to form a second treated sample, wherein the second surfactant has a hemolytic activity higher than a hemolytic activity of the first surfactant;

staining the second treated sample with a fluorescent dye to form a stained sample;

introducing the stained sample into a flow cytometer;

detecting fluorescent light information; and

distinguishing the malaria parasite based on the fluorescent light information.

6. The method of claim 5, wherein the flow cytometer

detects scattering light information.

7. The method of claim 6, wherein the scattering light information comprises scattering light intensity and the fluorescent light information comprises fluorescent light intensity.

8. The method of claim 7, wherein the scattering light intensity and the fluorescent light intensity are used to prepare a two dimensional distribution diagram, wherein a zone corresponding to malaria parasite existence is selected, and wherein a number of cells of the malaria parasite in the zone is counted.

9. The method of claim 5, wherein the fluorescent light information comprises fluorescent light intensity, and wherein the method further comprises:

obtaining a frequency distribution of malaria parasite having a fluorescent light intensity within a range; and

counting a number of cells of the malaria parasite within the range.

10. An apparatus for automatically detecting a malaria parasite comprising:

a chamber configured to receive a sample comprising a malaria parasite to prepare a measurement sample, wherein the measurement sample is obtained by (i) treating the sample comprising the malaria parasite with a first hemolytic agent comprising a first surfactant to form a first treated sample, (ii) treating the first treated sample with a second hemolytic agent comprising a second surfactant to form a second treated sample, wherein the second surfactant has a hemolytic activity higher than a hemolytic activity of the first surfactant, and (iii) staining the second treated sample with a fluorescent dye;

a flow cytometer for detecting fluorescent light information from the measurement sample; and

a control unit for distinguishing the malaria parasite based on the fluorescent light information.

11. The apparatus of claim 10, wherein the flow cytometer detects scattering light information from the measurement sample, and the control unit distinguishes the malaria parasite based on the fluorescent light information and the scattering light information.

12. The apparatus of claim 11, wherein the scattering light information comprises scattering light intensity

and the fluorescent light information comprises fluorescent light intensity.

13. A reagent kit for detecting a malaria parasite comprising:

a first hemolytic agent comprising a first surfactant;

a second hemolytic agent comprising a second surfactant having a hemolytic activity higher than a hemolytic activity of the first surfactant; and

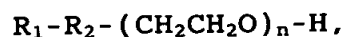
a fluorescent dye for staining the malaria parasite.

14. The reagent kit of claim 13, wherein the fluorescent dye for staining the malaria parasite is contained in at least one of the first hemolytic agent and the second hemolytic agent.

15. The reagent kit of claim 13, wherein the fluorescent dye for staining the malaria parasite is packaged separately from the first hemolytic agent and the second hemolytic agent.

16. The reagent kit of claim 13, wherein the first surfactant comprises a nonionic surfactant.

17. The reagent kit of claim 16, wherein the nonionic surfactant has a formula



wherein:

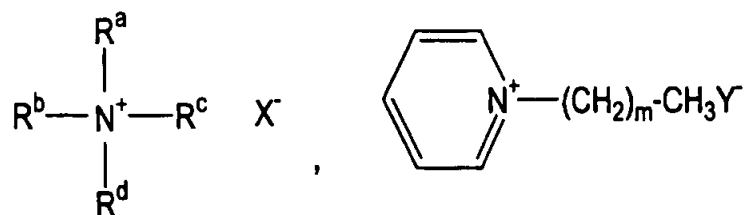
R_1 is an alkyl, alkenyl or alkynyl group having 10 to 22 carbon atoms;

R_2 is -O-, $-(C_6H_4)-O-$ or $-COO-$; and

n is an integer from 8 to 120.

18. The reagent kit of claim 13 wherein the second surfactant comprises a cationic surfactant.

19. The reagent kit of claim 18, wherein the cationic surfactant comprises a formula:



wherein:

R^a is an alkyl, alkenyl or alkynyl group having 8 to 20 carbon atoms;

each of R^b , R^c and R^d , independently, is an alkyl, alkenyl or alkynyl group having 1 to 8 carbon atoms;

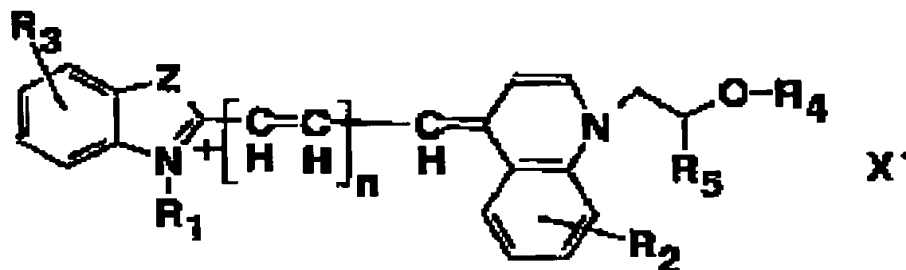
each of X^- and Y^- , independently, is an anion;

and

m is an integer from 7 to 19.

20. The reagent kit of claim 19, wherein the cationic surfactant is selected from the group consisting of octyltrimethylammonium bromide, decyltrimethylammonium bromide, lauryltrimethylammonium chloride, myristyltrimethylammonium bromide, and cetylpyridium chloride.

21. The reagent kit of claim 13, wherein the fluorescent dye is selected from the group consisting of a compound having a formula



wherein:

R_1 is a hydrogen atom or a lower alkyl group;

each of R_2 and R_3 , independently, is a hydrogen atom, a lower alkyl group or a lower alkoxy group;

R_4 is a hydrogen atom, an acyl group or a lower alkyl group;

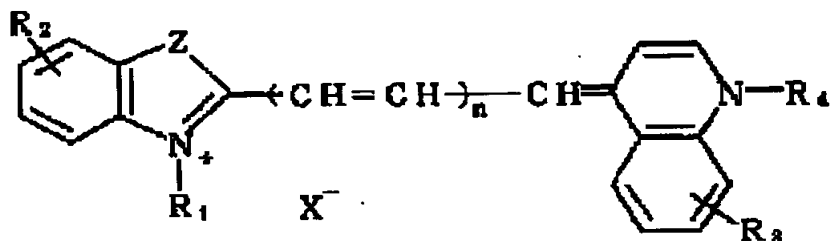
R_5 is a hydrogen atom or an optionally substituted lower alkyl group;

Z is a sulfur atom, an oxygen atom or a carbon atom substituted by two lower alkyl groups;

n is 1 or 2;

and X^- is an anion;

a compound having a formula



wherein:

R_1 is a hydrogen atom or an alkyl group;

each of R_2 and R_3 , independently, is a hydrogen atom, a lower alkyl group or a lower alkoxy group;

R_4 is a hydrogen atom, an acyl group or an alkyl group;

Z is a sulfur atom, oxygen atom or carbon atom substituted by two lower alkyl groups;

n is 0, 1 or 2; and

X^- is an anion;

acridine acridine orange, thiazole orange, ethidium bromide, propidium iodide, auramine O, Hoechst 33258, Hoechst 33342, rhodamine 123, and DiOC1(3).

22. The reagent of claim 13 wherein each of the first hemolytic agent and the second hemolytic agent has an osmotic pressure of between about 150 and about 600 mOsm/kg.